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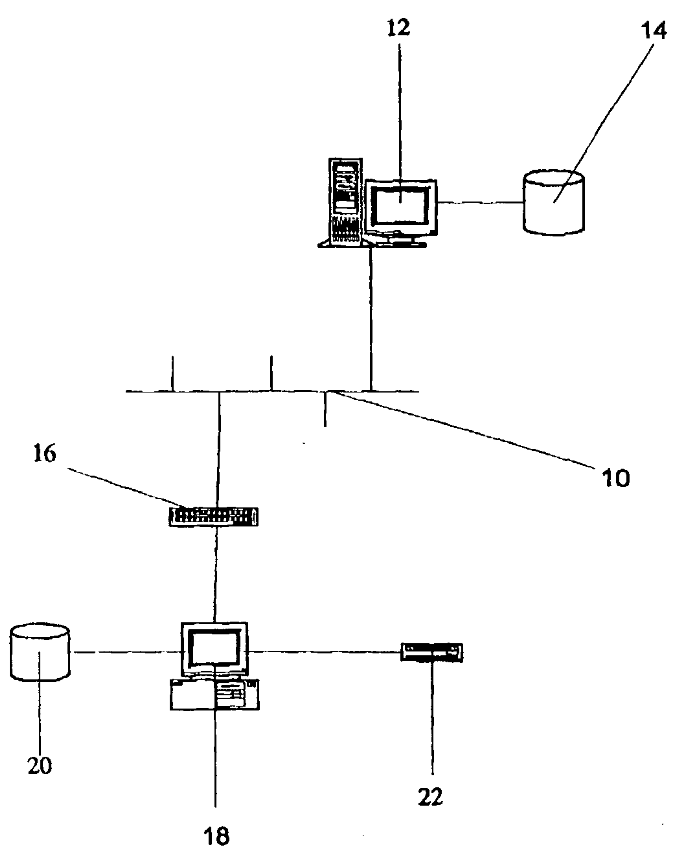
(54) Title: REMOTE INSTALLATION OF COMPUTER OPERATING SYSTEMS

(57) Abstract

In a method of installing a computer operating system from a network to a computer and configuring the computer for use on the network or on another network, an installation routine is run which accepts an input of a build location and a delivery location, interrogates an environment database with the build location and the delivery location to obtain one or more build specific variables and one or more delivery specific variables, accesses the network using the build specific variables, copies a master installation script from an operating system installation source stored on the network, and modifies the copied installation script in dependence on the build specific variables and delivery specific variables to create a dedicated installation script. The computer operating system is subsequently installed automatically using the dedicated installation script. The installation process may also include the step of registering the computer with the network where it is to be used upon so that it is ready for immediate use at the delivery location.



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REMOTE INSTALLATION OF COMPUTER OPERATING SYSTEMS

Field of the Invention

The present invention relates to the remote installation of computer operating systems for networked computers.

Background to the Invention

It has become common in business organisations to connect computers together by cabling in a network so that resources such as printers and files may be shared and also to permit the use of facilities such as electronic mail, the Internet and company intranets. Such networks may be in the form of a local area network (LAN) where computer workstations in a single physical location, for example a building, are connected to each other and to a computer acting as a network server. The network server typically controls security access to the network and regulates resource sharing. There may be more than one network server on a LAN, for example each floor of the building may have its own dedicated server.

With the advent of cheap, high capacity, telecommunications it has become possible to connect individual LANs together to form wide area networks (WANs). This interconnection permits large scale resource sharing and is the basis of the Internet. Large organisations use such technology to form their own intranets allowing secure organisation-wide e-mail and file sharing.

In large LANs or WANs, with hundreds or even thousands of computer workstations and many servers, administration or management of the individual computer workstations can be a cumbersome task. Manual installation of each computer workstation is a labourious and time consuming task, often taking several hours to complete. During the installation and configuration of a computer operating system, the installer must select the configuration and the software components to be installed that conforms to the machine, the organisation-wide policy, the LAN requirements and the end user requirements. This can mean that the configuration of computers across

WANs will vary significantly and even the configuration of computers across the same LAN may be different. Each system administrator must be familiar with each differing configuration on any LAN or WAN they are expected to support as each configuration may raise its own support issues and possible conflicts with policy. In response to this, many organisations now have organisation-wide policies which define the software and hardware configuration of each computer workstation in an attempt to produce standardised configurations and thereby ease these support problems.

It is now possible to install computer operating systems from a data store on a network to a particular computer workstation. This can be achieved using pre-written scripts setting installation and configuration options to facilitate automatic installation. However, these scripts can generally only be used for the standardized installation of an operating system from a LAN with a single server.

Summary of the Invention

According to a first aspect of the present invention, there is provided a method of installing a computer operating system, comprising the steps of running an installation routine on a computer in which the installation routine accepts user inputs defining a delivery location and is operative to connect the computer to an operating system installation source held on a remote computer, retrieve a copy of a master installation script held on the remote computer, and modify the copied master installation script in dependence on a number of variables associated with the delivery location to create a dedicated installation script, and subsequently installing automatically the computer operating system using the dedicated installation script.

To save the system administrator and computer workstation having to be at the physical location where the computer workstation is to be used, it is desirable that an operating system can be installed and configured elsewhere, such as at the equipment supplier's premises or at a centralised IT/support centre, the installation possibly being performed in a different language to that required by the end user and possibly without a network connection to the LAN and server where the computer workstation is to be used. It is furthermore desirable that a computer installed and configured at a first location for use

at a second location will be configured exactly the same as a computer installed and configured at a third location for use at the second location.

The present invention provides an installation procedure in which the installation and configuration of each workstation is standardised and repeatable. The present invention also provides an installation procedure in which the installation process is essentially automated, thereby reducing the amount of time an installer must spend at each machine to provide a machine ready to be used upon delivery. Furthermore, the present invention provides an installation method and system where a computer operating system can be installed and configured at a first location for use at a second location, where the second location need not necessarily be on the same LAN or WAN as the first location.

Preferably, the installation routine is operative to retrieve the computer operating system from the remote computer and subsequently disconnect the computer from the remote computer, wherein the computer is then re-booted and the computer operating system installed using the dedicated installation script. The installation routine may also accept user inputs defining a build location corresponding to the location of the remote computer where the operating system installation source is held.

The remote computer may be connected to a network and the delivery location may be on the same network as the remote computer. Alternatively, the delivery location may be on a different network to the remote computer. The remote computer need not necessarily be at the same physical location or on the same LAN as the computer being installed and configured provided that a data connection to the remote computer is possible. In this way, any suitable alternative remote computer may be used if the preferred remote computer is unavailable. The data connection to the remote computer may be made via the Internet.

Preferably, the installation routine accepts a user input defining a unique identifier for the computer. More preferably, the unique identifier is used to register the computer with a network on which the computer is to be used. If a data connection to the delivery location is not possible, such as when the installation and configuration process is performed by

an external contractor using their own build site, the registration may be postponed until the computer workstation is started after delivery.

Preferably, the installation routine is initiated by running a computer program held on a storage device.

Preferably, the storage device holds a database containing a number of delivery specific variables associated with a number of possible delivery locations, whereby the delivery specific variables are used to modify the master installation script. The database may also contain a number of build specific variables associated with a number of possible build locations which are used to connect the computer to a remote computer.

Preferably, the storage device stores a number of network drivers from which the user selects an appropriate driver to enable connection to the remote computer.

Preferably, the storage device is a computer disk. However, it may be any computer readable media capable of storing the aforementioned instructions.

According to a second aspect of the present invention, there is provided a system for installing a computer operating system comprising: a computer; a network to which the computer may be connected; a remote computer connected to the network which holds an operating system installation source and a master installation script file; and, a storage device which holds a set of computer executable instructions and a number of files for performing an installation routine in accordance with the first aspect of the present invention when run on the computer.

According to a third aspect of the present invention, there is provided a program storage device readable by a machine and encoding a program of instructions and a number of files for executing the method of the first aspect of the present invention.

Preferably, the machine is a general purpose computer.

Brief Description of the Drawings

Examples of the present invention will now be described in detail with reference to the accompanying drawings, in which:

Figure 1 is a schematic of a typical computer hardware arrangement used in the remote installation of a computer operating system in accordance with the present invention:

Figure 2 is a flow chart which outlines a typical installation routine according to the present invention:

Figure 3 is a flow chart expanding upon a particular step of the installation routine shown in Figure 2:

Figure 4 is an expanded schematic of the hardware arrangement shown in Figure 1 including an end-use network where a workstation is to be used;

Figure 5 is a flow chart of a more specific example of an installation routine according to the present invention: and,

Figure 6 is a flow chart expanding upon a particular step of the installation routine illustrated in Figure 5.

Detailed Description

A typical arrangement of the computer hardware used in the remote installation of a computer operating system in accordance with the present invention is shown in Figure 1. A network 10 connects a network server 12 and a network data store 14 to a network interface device 16. The network interface device 16 is connected to a computer workstation 18 with a random access disk memory 20. For a brand-new machine the disk memory 20 does not contain a computer operating system.

In the present invention, a 3½ inch disk or other suitable storage device 22 is used to boot the computer workstation 18. During the boot, an installation program held on the

computer storage device 22 is run on the computer workstation 18. As will be described in detail below. when running an installation routine controlled by the software the installer is prompted to identify the particular network interface device 16 and to input a build location code. a delivery location code and a unique identifier for the computer workstation 18. Subsequently. by using this data. the installation routine is able to connect the computer workstation 18 to the network 10 via the network interface device 16. The installation routine then automatically installs an appropriate computer operating system from a remote computer operating system installation source held in the network data store 14 onto the disk memory 20 of the computer workstation 18. As will be described below. the installation routine is adapted to configure the computer operating system in dependence on the delivery location code. The build location code refers to where the build process is to be carried out. whilst the delivery location code refers to where the built computer workstation is to be located.

An overview of the installation routine will now be described with reference to the flow chart of Figure 2. As indicated. having inserted the installation disk and switched the computer workstation on. the installer is prompted to input a build location code and a delivery location code in step 100. An environment database in a look-up table stored on the installation disk is then interrogated with the build location code and the delivery location code (step 102) to obtain build location specific variables and delivery location specific variables which are stored by the computer workstation in step 104. The installer is also prompted to enter a unique identifier for the computer workstation (step 106). Using the build location specific variables the installation routine connects the computer workstation to the network in step 108 and accesses an installation account on the server. A master installation script held with the computer operating system installation source on the network data store is copied onto the disk memory of the computer workstation in step 110. The copy of the installation script is then modified in dependence on the build location specific variables and on the delivery location specific variables (step 112) to create a dedicated installation script. The computer operating system is then installed and configured using the computer operating system installation source setup routine with the dedicated installation script in step 114.

The installation and configuration step 114 of Figure 2 is expanded upon in the flow chart of Figure 3. As shown, the computer operating system installation source is copied from the network data store onto the disk memory (such as a hard disk) of the computer workstation in step 200. The setup routine then disconnects from the network and reboots the computer workstation in step 202. After the reboot of the computer workstation, the setup routine installs the computer operating system using the dedicated installation script (step 204). The computer operating system is then configured in dependence upon the dedicated installation script in step 206. Any additional software components such as e-mail and office application suites specified in the installation script are installed from the network data store at this time (step 208). The setup routine also cleans up the disk memory of the computer workstation by deleting any unnecessary files in step 210. The setup routine ends once the computer workstation has a complete computer operating system ready for use at the delivery location.

The schematic of Figure 4 includes the computer hardware arrangement of Figure 1 in addition to a network 30 and a network server 32 to which the computer workstation 18 is intended to be connected. The network 10 may be a part of the same LAN as the network 30. it may be a part of the same WAN as the network 30 connected by a telecommunications system. or there may be no network connection to the network 30. If there is a connection between the network 10 and the network 30 that the computer workstation 18 is intended to be used upon, then the installation routine registers the computer workstation 18 by its unique identifier with the network 30 and network server 32 where the computer workstation 18 is to be used. If there is no connection to the network 30 that the computer workstation 18 is intended to be used upon the registration is re-run when the computer is first started at the delivery location.

A more specific example of the present invention will now be described with reference to Figures 4 and 5. In this example, the network 10 is an ethernet network, with network servers 12, 32 operating under Microsoft Windows NT Server operating system V.4 and the computer operating system installation source is Microsoft Windows NT workstation. The computer storage device 22 is an MS-DOS formatted disk holding an MS-DOS v.6.22 operating system kernel and files necessary to boot the computer workstation 18, the

installation routine, the environment database and TCP/IP network drivers for each selectable network interface device 16. The computer workstation 18 is a Hewlett-Packard Vectra XM/4 5/166 Personal Computer with 32MB of random access memory. The disk memory 20 of the computer workstation is a 1.2GB hard disk drive. The network interface device 16 is a 3COM Etherlink 2 3C503/16 ethernet network card installed in the computer workstation 18.

When the computer workstation 18 is booted with the computer storage device 22 inserted in the computer's disk drive, the operating system kernel on the computer storage device 22 takes control of the boot routine and prompts the user to select the network interface device 16 used from a list of supported network interface devices using the MS-DOS v.6.22 start-up menu facility in step 300. The TCP/IP network drivers corresponding to a network interface device selected from the list are copied to default file names (step 302) so that the install routine may access any of the supported network interface devices without knowledge of the specific type. The boot routine then runs the installation routine in step 304. The installation routine accepts an input of a build location code (step 305) and a delivery location code (step 306). The build location code and delivery location code are cross-referenced with a list of allowable locations in respective steps 307, 308 and if the locations are not on the list, a list of the allowable locations is displayed in respective steps 309, 310 and the installer is prompted to re-enter the code in respective steps 305, 306. If six incorrect attempts at entering an allowable location are made the installation routine ends and reports an error in respective steps 309a and 310a. After a valid build location code and a valid delivery location code are entered, the installation routine accepts an input of a unique identifier for the computer workstation (step 311) to be later used as its DNS address. The installation routine interrogates the environment database with the build location code and the delivery location code in step 312 to obtain build location specific variables and delivery location specific variables. The variables relate to environment and network specific settings for the two locations, as can be seen from Table 1.

Code	Location	Server	Share	File System	Keyboard Layout	Logon Domain	Join Domain	Timezone
CR	Crewe	UK_CRID	ID4	NTFS	UK	UK_G	UK_C	GMT
GR	Greenford	UK_ID	ID4	NTFS	UK	UK_G	UK_1	GMT
REM	Remote Build Site	UKGW	ID4	NTFS	UK	UK_REM	UK_REM	GMT
UK	GW UK at Stockley	UK_ID4	ID4	NTFS	UK	UK_G	UK_1	GMT
UK_1	GW UK Backup at Stockley	UKB_ID4	ID4	NTFS	UK	UKB_G	UKB_1	GMT
US	US RTP Primary	US0001	ID4	NTFS	US	US1	US_D	GMT-5

Table 1

The build location specific variables "server" and "share" define the server and network data store holding the computer operating system installation source. If, for example, the build location UK is entered, the computer operating system installation source would be installed from ID4 on the UK_ID4 server.

Using these variables in combination with the TCP/IP drivers and the unique identifier, the installation routine logs the computer workstation onto the network in step 313. The IP address for the computer is obtained from the server using DHCP (dynamic host configuration protocol) and the unique identifier is used for the DNS address. A computer disk format utility is run to format the disk memory 20 of the computer workstation 18. A master installation script stored on the network data store with the computer operating system software source is copied onto the disk memory (step 314). An example of a master installation script is shown below:

[Unattended]
OemPreinstall = yes
OemSkipEula = yes
NoWaitAfterTextMode = 1
NoWaitAfterGUIMode = 1
FileSystem =

ExtendOEMPartition = 1,nowait
ConfirmHardware = no
NtUpgrade = no
Win31Upgrade = no
TargetPath = WINNT
OverwriteOemFilesOnUpgrade = no
KeyboardLayout =

[GUIUnattended]
TimeZone =

[OEM Ads]
Banner = "Glaxo Wellcome. GIS ID4 v3.0 Installation.*Windows NT v4.0 Workstation."
Background = gis.bmp

[UserData]
FullName = "Glaxo Wellcome"
OrgName = "Glaxo Wellcome"
ComputerName =

[Display]
ConfigureAtLogon = 0
BitsPerPel = 8
XResolution = 800
YResolution = 600
VRefresh = 60
AutoConfirm = 1

[Network]
InstallProtocols = Glaxo_Protocol_List
InstallInternetServer = Glaxo_Internet_List
JoinDomain =

CreateComputerAccount =

```
[Glaxo_Protocol_List]
TC = TCPIP_Parameters

[TCPIP_Parameters]
MCP=Yes

[Glaxo_Internet_List]
InstallNETSTP = 0
InstallMOSAIC = 0
```

The installation routine then modifies the copied script in dependence on the build location specific variables and on the delivery location specific variables (step 315) to create a dedicated installation script. In the above example, the script fields shown in bold are edited by inserting the delivery location specific variables, the field names corresponding to the column headings of Table 1. The unique identifier is entered as the ComputerName.

The installation routine then proceeds in step 316 to accept inputs relating to the selection of additional software to be installed. Such additional software may include drivers to access other network protocols, office application suites and e-mail client software. The installation routine ends by running the Windows NT set-up routine held with the computer operating system source on the network store. The Windows NT set-up routine is run in step 317 in an unattended installation mode using the dedicated installation script to provide answers to questions usually asked during a manual set-up. The set-up routine proceeds substantially as has been described with reference to Figure 3.

Windows NT requires that each computer workstation has its own DNS (Domain Name Service) address and that the address is registered with the network domain in which the computer workstation is to be used. With reference to the example of Figure 5, the configuration Step 206 of Figure 3 is expanded upon in the flow chart of Figure 6. Prior to the set-up routine ending, the routine reconnects the computer workstation to the

network 10 using the newly installed computer operating system (step 412) and an attempt is made (step 414) to connect to the network where the computer workstation is intended to be used. If this is successful, the unique identifier for the computer is registered as the computer workstation's DNS address with the Windows NT network domain and server that the computer workstation is intended to be used upon in step 416. The computer workstation then disconnects from the networks (step 418) and is ready for use upon delivery to the location where it is intended to be used. If the attempt is not successful, the installation fails.

Where an outside organisation is contracted to supply and configure the computer workstation, a connection to the network where the computer workstation is intended to be used is not possible. To overcome this, a remote build site code relating to the outside organisation's own network is used for the build location code (REM in Table 1). In step 315 of Figure 5, when the copied script is modified, the location specific variables relating to the remote build site code are used for both the build location specific variables and the delivery location specific variables. The delivery location code entered is stored for later use. When an attempt is made to connect to the computer workstation to the network domain and server upon which the computer workstation is intended to be used (step 414), the connection is actually made to the remote build site network permitting the set-up routine to complete. When the computer workstation is delivered by the outside organisation to the delivery location, the configuration of the computer operating system is updated in dependence on the stored delivery location code. The unique identifier of the computer workstation is then registered with the Windows NT network domain and server that the computer workstation is intended to be used upon at the delivery location according to the previously described steps 414 to 418 of Figure 6.

Claims:

1. A method of installing a computer operating system, comprising the steps of running an installation routine on a computer in which the installation routine accepts user inputs defining a delivery location and is operative to connect the computer to an operating system installation source held on a remote computer, retrieve a copy of a master installation script held on the remote computer, and modify the copied master installation script in dependence on a number of variables associated with the delivery location to create a dedicated installation script, and subsequently installing automatically the computer operating system using the dedicated installation script.

2. A method according to claim 1, in which the installation routine is operative to retrieve the computer operating system from the remote computer and subsequently disconnect the computer from the remote computer, whereby the computer is then re-booted and the computer operating system installed using the dedicated installation script.

3. A method according to claim 1 or 2, in which the installation routine also accepts user inputs defining a build location corresponding to the location of the remote computer where the operating system installation source is held.

4. A method according to any preceding claim, in which the remote computer is connected to a network.

5. A method according to claim 4, in which the delivery location is on the same network as the remote computer.

6. A method according to claim 5, in which the delivery location is on a different network to the remote computer.

7. A method according to any preceding claim, in which the installation routine also accepts a user input defining a unique identifier for the computer.

8. A method according to claim 7, further comprising the step of registering the computer with a network using the unique identifier.

9. A method according to any preceding claim. in which the installation routine is initiated by running a computer program held on a storage device.

10. A method according to claim 9. in which the storage device is a computer disk which is inserted into a drive of the computer.

11. A method according to claim 9 or 10. in which the storage device holds a database containing a number of delivery specific variables associated with a number of possible delivery locations. whereby the delivery specific variables are used to modify the master installation script.

12. A method according to claim 11. in which the database contains a number of build specific variables associated with a number of possible build locations which are used to connect the computer to the remote computer.

13. A method according to any of claims 9 to 12. in which the storage device stores a number of network drivers from which the user selects an appropriate driver to enable connection to the remote computer.

14. A method according to any preceding claim. in which the computer connects to the remote computer by the internet.

15. A system for installing a computer operating system comprising:
a computer:
a network to which the computer may be connected;
a remote computer connected to the network which holds an operating system installation source and a master installation script file: and,
a storage device which holds a set of computer executable instructions and a number of files for performing an installation routine in accordance with the method of any preceding

claim when run on the computer.

16. A system for installing a computer operating system according to claim 15. in which the storage device is a computer disk.

17. A program storage device readable by a machine and encoding a program of instructions and a number of files for executing the method of a specified one of claims 1 through 14.

18. A program storage device according to claim 17. in which the machine is a general purpose computer.

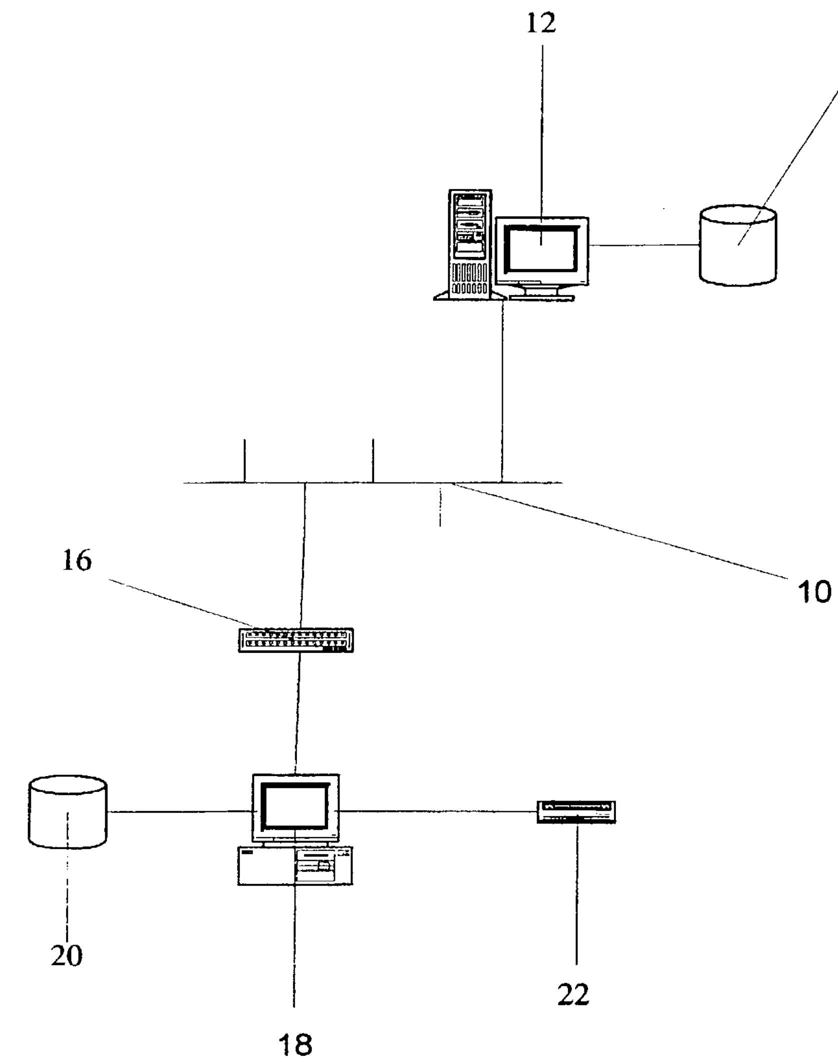


Fig. 1

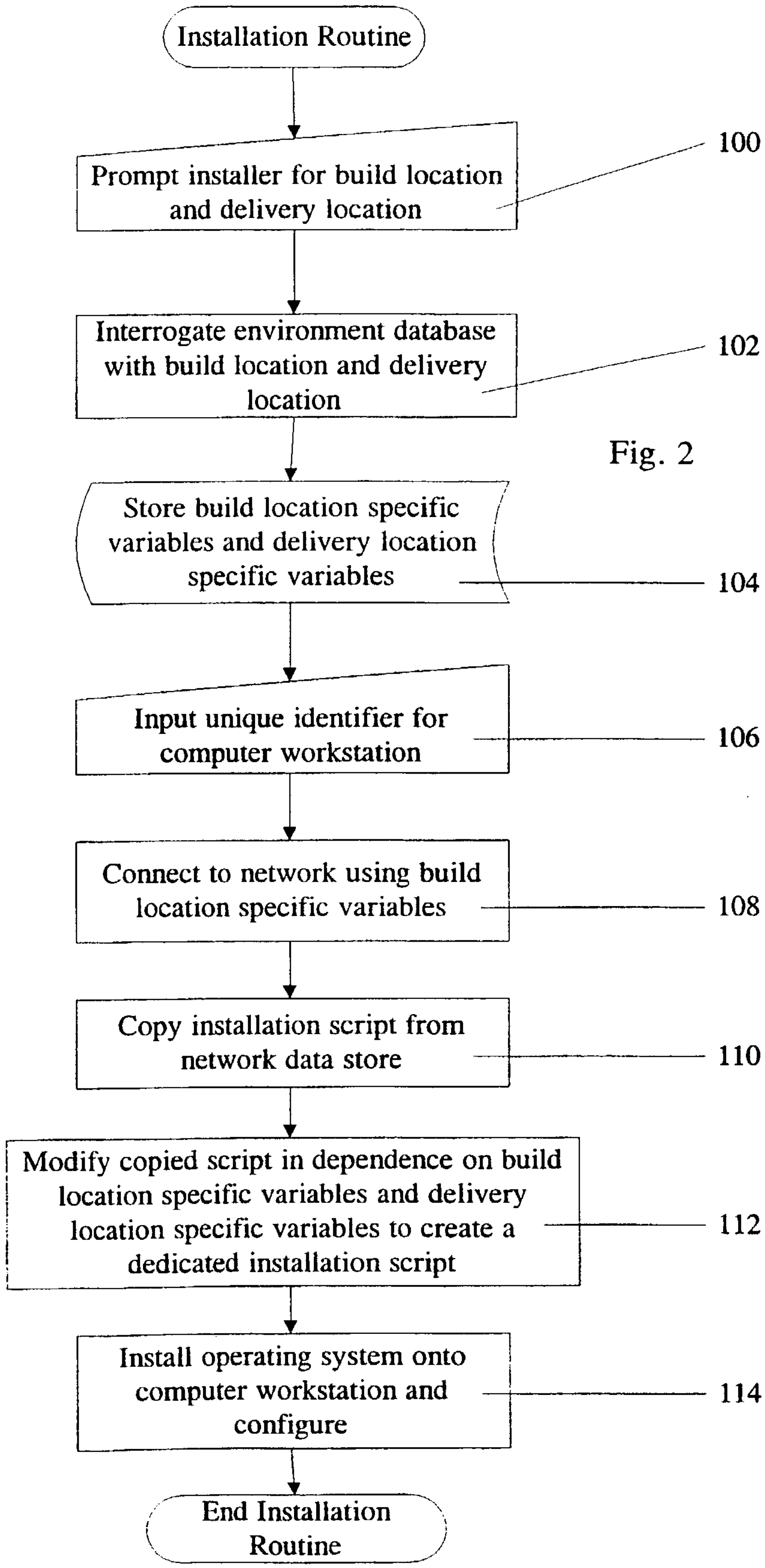

Installation Routine
Prompt installer for build location and delivery location
100
Interrogate environment database with build location and delivery location
102
Store build location specific variables and delivery location specific variables
104
Input unique identifier for computer workstation
106
Connect to network using build location specific variables
108
Copy installation script from network data store
110
Modify copied script in dependence on build location specific variables and delivery location specific variables to create a dedicated installation script
112
Install operating system onto computer workstation and configure
114
End Installation Routine

Fig. 2

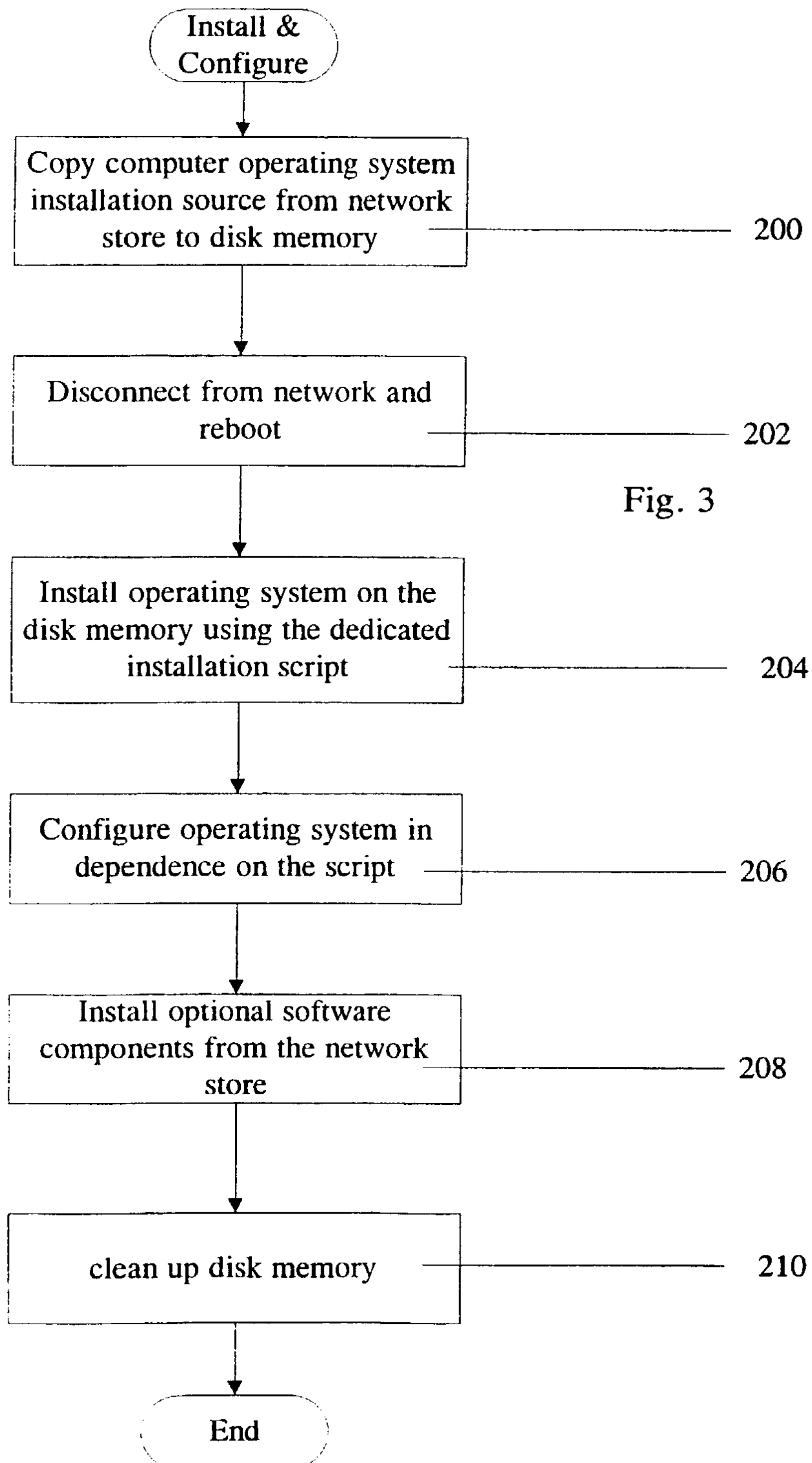

Install & Configure
Copy computer operating system installation source from network store to disk memory
200
Disconnect from network and reboot
202
Install operating system on the disk memory using the dedicated installation script
204
Configure operating system in dependence on the script
206
Install optional software components from the network store
208
clean up disk memory
210
End

Fig. 3

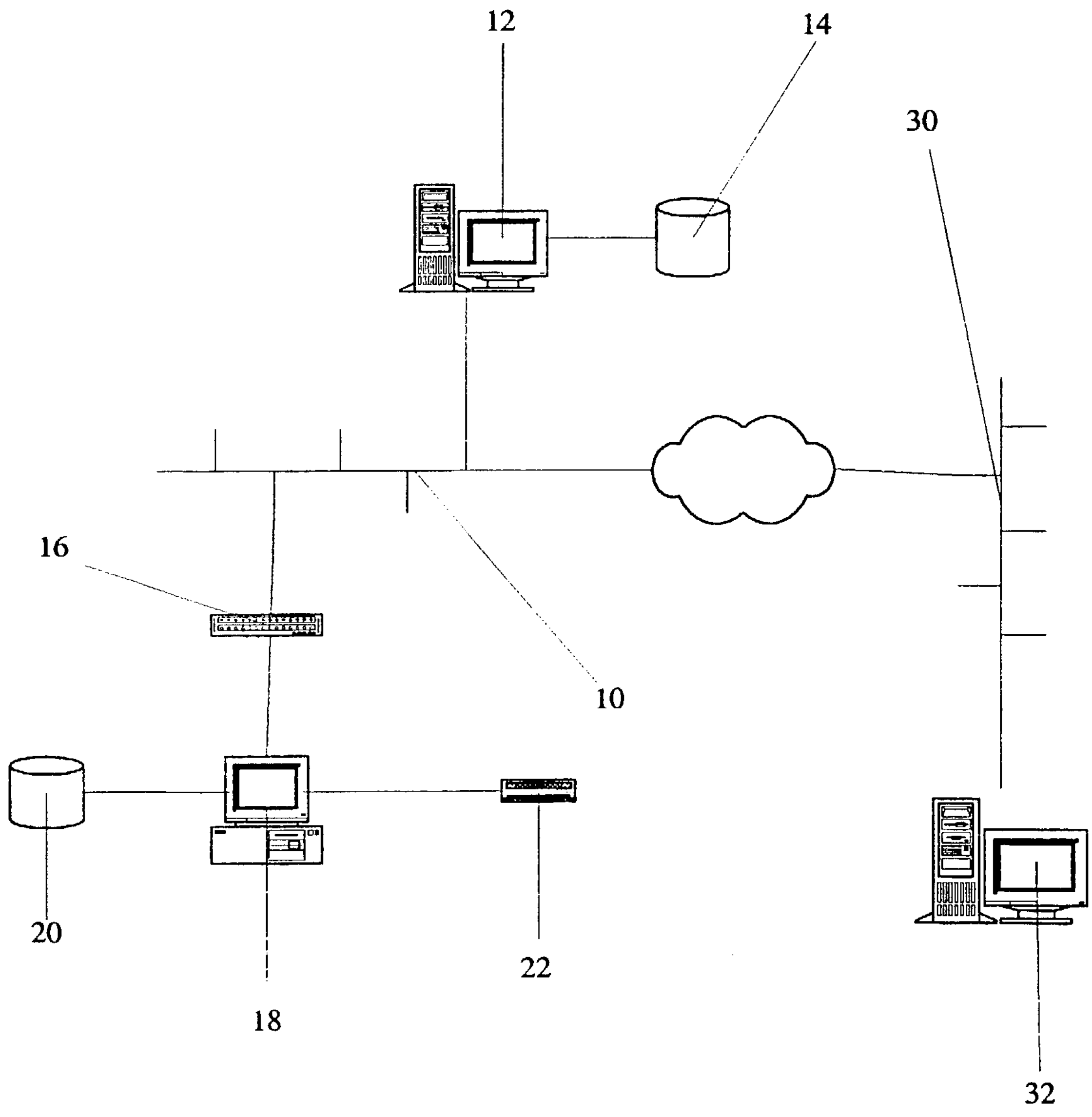


Fig. 4

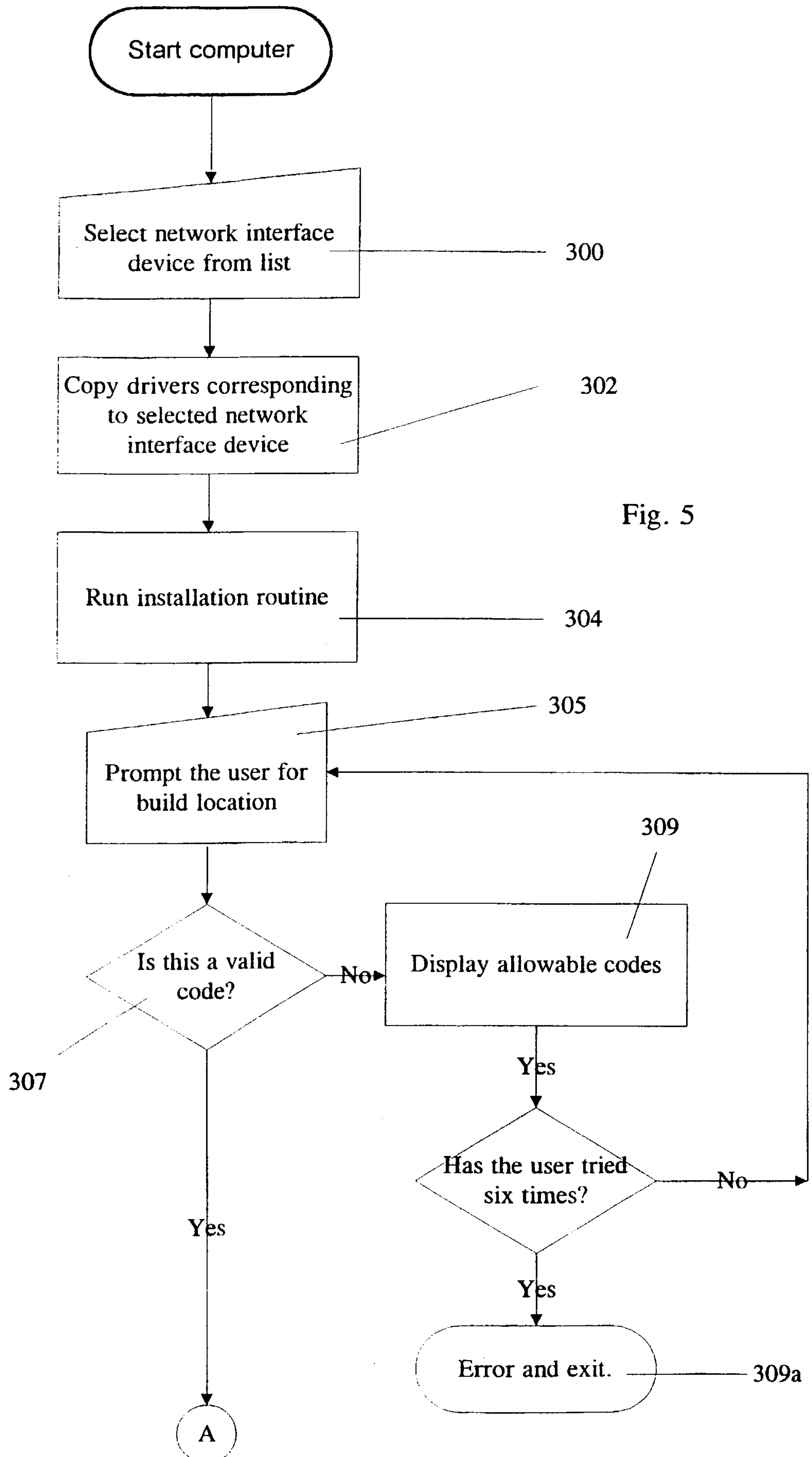
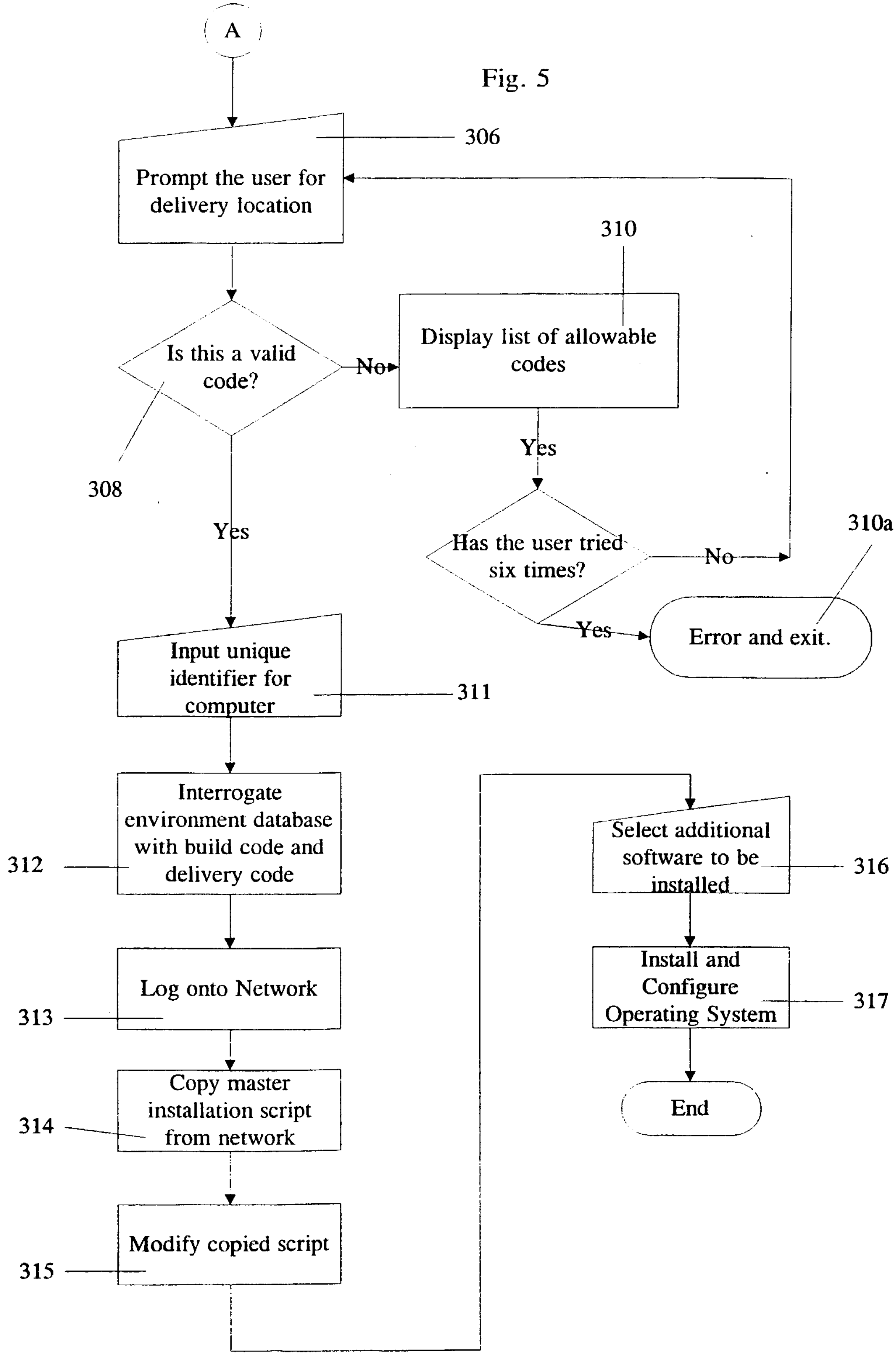

Start computer
Select network interface device from list
300
Copy drivers corresponding to selected network interface device
302
Run installation routine
304
305
Prompt the user for build location
309
Is this a valid code?
No
Display allowable codes
307
Yes
Has the user tried six times?
No
Yes
Yes
Error and exit.
309a
A

Fig. 5

Fig. 5


A
Prompt the user for delivery location
306
Is this a valid code?
308
No
Display list of allowable codes
310
Yes
Has the user tried six times?
No
310a
Yes
Error and exit.
Yes
Input unique identifier for computer
311
Interrogate environment database with build code and delivery code
312
Log onto Network
313
Copy master installation script from network
314
Modify copied script
315
Select additional software to be installed
316
Install and Configure Operating System
317
End

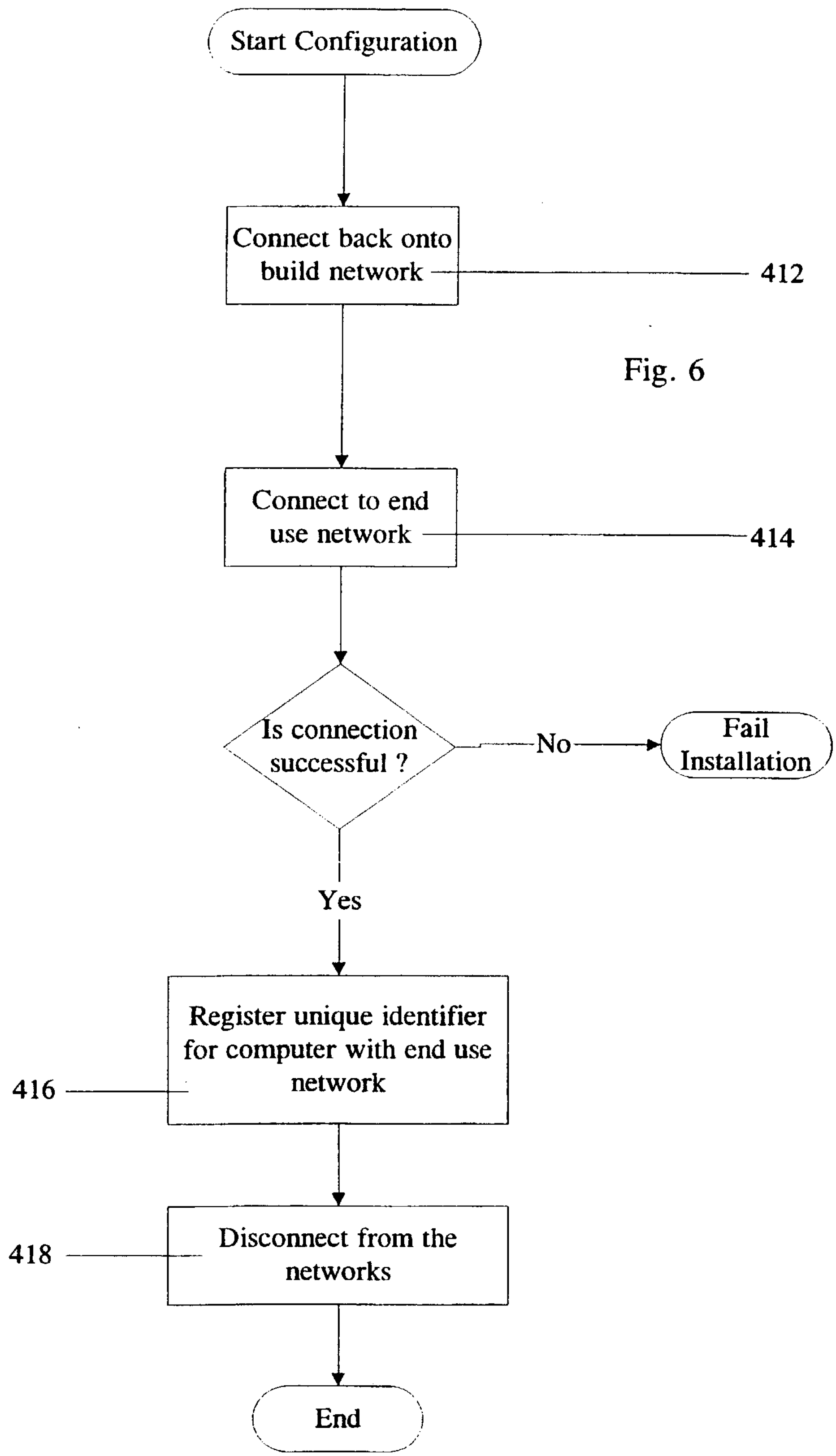

Start Configuration
Connect back onto build network
412
Connect to end use network
414
Is connection successful ?
No
Fail Installation
Yes
Register unique identifier for computer with end use network
416
Disconnect from the networks
418
End

Fig. 6

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 98/01356

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 G06F9/44

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 G06F H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	"REMOTE SOFTWARE INSTALLATION PROTOCOL" IBM TECHNICAL DISCLOSURE BULLETIN, vol. 34, no. 10A, 1 March 1992, pages 82-84, XP000302233	1,15
A	see the whole document	2-14, 16-18
A	PATENT ABSTRACTS OF JAPAN vol. 018, no. 189 (P-1721), 31 March 1994 & JP 05 346896 A (HITACHI LTD), 27 December 1993 see abstract	1-18
A	US 5 280 627 A (FLAHERTY JAMES E ET AL) 18 January 1994 see the whole document	1-4, 7-11, 13-17

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
9 November 1998	16/11/1998

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Cichra, M

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INTERNATIONAL SEARCH REPORT

Internat l Application No
PCT/GB 98/01356

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	GB 2 231 180 A (SUN MICROSYSTEMS INC) 7 November 1990 see the whole document -----	1-4, 7-11, 13-17

1

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			AU	609585	B	02-05-1991
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			DE	68928311	T	02-04-1998
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			AU	623708	B	21-05-1992
			AU	4587089	A	01-11-1990
			CA	2010965	A	26-10-1990
			JP	3018948	A	28-01-1991